

International geodetic and geophysical union. Assn. of scientific hydrology.

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## SOLAR OBSERVATIONS

[Meteorological Research Division, EDGAR W. WOOLARD in charge]

### SOLAR RADIATION OBSERVATIONS, JUNE 1938

By CHARLES M. LENNAHAN

Measurements of solar radiant energy received at the surface of the earth are made at eight stations maintained by the Weather Bureau, and at nine cooperating stations maintained by other institutions. The intensity of the total radiation from sun and sky on a horizontal surface is continuously recorded (from sunrise to sunset) at all these stations by self-registering instruments; pyrheliometric measurements of the intensity of direct solar radiation at normal incidence are made at frequent intervals on clear days at three Weather Bureau stations (Washington, D. C., Madison, Wis., Lincoln, Nebr.) and at the Blue Hill Observatory of Harvard University. Occasional observations of sky polarization are taken at the Weather Bureau stations at Washington and Madison.

The geographic coordinates of the stations, and descriptions of the instrumental equipment, station exposures,

and methods of observation, together with summaries of the data, obtained up to the end of 1936, will be found in the MONTHLY WEATHER REVIEW, December 1937, pp. 415 to 441; further descriptions of instruments and methods are given in Weather Bureau Circular Q.

Table 1 contains the measurements of the intensity of direct solar radiation at normal incidence, with means and their departures from normal (means based on less than 3 values are in parenthesis). At Madison and Lincoln the observations are made with the Marvin pyrheliometer; at Washington and Blue Hill they are obtained with a recording thermopile, checked by observations with a Marvin pyrheliometer at Washington and with a Smithsonian silver disk pyrheliometer at Blue Hill. The table also gives vapor pressures at 8 a. m. (75th meridian time) and at noon (local mean solar time).

During June 1938 direct solar radiation intensities averaged above normal at Blue Hill and Madison, about normal at Lincoln, and below normal at Washington.

Table 2 contains the average amounts of radiation received daily on a horizontal surface from both sun and sky during each week, their departures from normal and the accumulated departures since the beginning of the year. The values at most of the stations are obtained from the records of the Eppley pyrheliometer recording on either a microammeter or a potentiometer.

One half of the stations received an excess and the other half a deficiency of total solar and sky radiation during June 1938. Of the six stations showing an excess in May, New York is the only one which does not show an excess in June.

Polarization measurements were made on 6 days at Madison giving a mean value of 47.1 percent and a maximum of 55.3 percent on the 8th; both of these values are below the corresponding normals for the month.

TABLE 1.—*Solar radiation intensities during June 1938*

[Gram-calories per minute per square centimeter or normal surface]

## WASHINGTON, D. C.

Date	Sun's zenith distance										
	8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	Noon
	75th mer. time	Air mass									Local mean solar time
	e	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e
June 1	7.87	0.66	0.73	0.90	1.11	1.51	cal.	cal.	cal.	cal.	mm.
June 2	11.38				0.89	1.30					6.02
June 6	9.47	0.38	0.49	0.66	1.00						12.68
June 7	16.20	0.37	0.46	0.61	0.97						9.14
June 13	8.81	0.32	0.42	0.60	0.97						14.60
June 14	9.47				1.04						8.81
June 15	10.59				1.00						9.14
June 23	16.20				1.10						10.59
June 24	15.65				1.06						12.68
June 29	8.81				1.34						16.20
Means		0.43	0.52	0.69	1.00	1.26					
Departures		-13	-15	-10	+05	+01					

## MADISON, WIS.

June 2	10.21		0.94	1.08	1.24						8.18
June 7	7.04		0.98	1.14	1.31	1.48					5.79
June 8	6.50		0.87	1.02	1.24	1.47					7.04

TABLE 1.—*Solar radiation intensities during June 1938—Continued*  
MADISON, WIS.—Continued

Date	Sun's zenith distance										Noon
	8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	
	75th mer. time	Air mass									
	e	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e
June 18	11.81	0.67	0.77	0.91	1.10		cal.	cal.	cal.	cal.	mm.
June 29	11.38	0.57	0.71	0.84	1.00		1.25				12.68
June 27	7.57		0.87	0.98	1.16						14.10
June 29	7.57	0.78									0.14
Means		0.67	0.86	1.00	1.18	1.40					9.14
Departures		-06	+01	+03	+13	+07					

## LINCOLN, NEBR.

June 2	9.47	0.69	0.81	0.93	1.10		1.21				8.48
June 3	10.97						1.22				13.13
June 4	9.47	0.68	0.82	0.96	1.13	1.40	1.14	0.90	0.70	0.60	6.76
June 7	7.57	0.60	0.71	0.86	1.02	1.30					6.50
June 12	9.47						1.16				0.14
June 14	15.11						0.96				14.10
June 15	12.24	0.72	0.82	0.95	1.14	1.43	1.16				13.13
June 16	14.60							1.14			14.60
June 21	16.79							1.17			15.65
June 23	16.20							1.31	1.02		17.96
June 24	17.37				0.76	0.90	1.08	1.35			16.79
June 27	9.14	0.77	0.88	1.01	1.17	1.43	1.14				6.50
June 30	17.96							0.93			16.79
Means		0.69	0.80	0.94	1.10	1.37	1.13	0.90	0.70	0.60	
Departures		-05	+01	+01	-01	+01	+02	-02	-09	-07	

## BLUE HILL, MASS.

June 1	8.3	0.86	0.96	1.08	1.20	1.26	1.05	0.82			7.9
June 2	7.9			1.20	1.37	1.43	1.37	0.90			9.6
June 6	7.9		1.33	1.37	1.41	1.45	1.28	1.21			18.2
June 7	13.2		0.74	0.89	1.06		1.27				15.8
June 9	11.1		1.08	1.16	1.28	1.42					6.1
June 13	9.4					1.37					16.9
June 14	9.9					1.10	1.32				10.3
June 15	8.8						1.48	1.26			9.9
June 20	13.2						1.18	1.35	1.25		11.5
June 21	13.2						1.22	1.33			12.8
June 24	14.7						0.92	1.02			18.8
Means		(0.86)	1.03	1.14	1.19	1.35	1.25	0.98			
Departures		0.00	+04	+10	+10	+06	+15	-04			

TABLE 2.—*Average daily totals of solar radiation (direct+diffuse) received on a horizontal surface*

Week beginning—	Grain-calories per square centimeter																
	Washington	Madison	Lincoln	Chicago	New York	Fresno	Fairbanks	Twin Falls	La Jolla	Miami	New Orleans	Riverside	Blue Hill	San Juan	Friday Harbor	Ithaca	Newport
June 4	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	
June 11	527	614	594	542	474	744	493	659	445	461	462	487	548	649	736	513	575
June 18	522	614	633	465	456	708	492	554	512	516	520	528	462	475	499	472	448
June 25	423	621	582	533	423	721	518	555	432	537	516	637	516	681	524	598	
	420	415	564	411	373	704	528	498	377	(1)	559	340	654	623	334	338	
Departures of daily totals from normals																	
June 4	+26	+99	+42	+93	+39	+77	+10	+77	-115	-43	-18	-57	+27	+74	+97	+45	
June 11	+24	+7	+84	+15	+14	+6	-2	-68	-52	+32	+30	-67	-67	-37	-49		
June 18	-69	+90	-1	+61	-10	-3	-2	-154	-8	-12	+67	-88	+104	-28	+83	+7	
June 25	-101	-117	-37	-31	-69	-15	+67	-200	-63	-109	(1)	-34	-166	+79	+47	-140	
Accumulated departures since Jan. 1																	
	-9,573	-3,528	-1,918	+3,010	+581	-2,499	+3,710	-7,128	-2,436	-2,205	+4,480	-3,619	-1,911	+7,355	+8,253	+1,176	

\* No record obtained due to instrumental trouble.